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ABSTRACT

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Guiding Preservice Teachers through the Internet and Technology Media for Science Instruction

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Abstract

In a science methods course for elementary teachers, an education professor and technical instructor collaborated to provide preservice teachers with skills to expand their knowledge of the Internet and understand its use as an instructional tool. Students learned searching techniques and how to critically evaluate of web resources. Educational principles and curriculum design were concurrently presented. After participating in the development of a science unit using the Internet, students were required to combine technology with science content to create instructional units.

The National Center for Education Statistics listed the number of classrooms that were connected to the Internet in 1994 at 3%, which increased to 70-75% by 1999. With so many classrooms connected to the Internet, it is crucial that teachers be able to lead students through the mass of accessible information. Teachers should also be using the information to enhance educational instruction. So, a technical instructor and education professor collaborated to teach a science methods course for preservice elementary teachers in order to provide students with experiences to expand their knowledge of the Internet and understand its use as an instructional tool.

As part of a grant initiative, funded by the Teagle Foundation, to increase the use of technology campus-wide at our college, we decided to integrate technology into instruction as a component for curriculum design in a preservice methods course for future elementary teachers. Our rationale in pursuing this project was that as college students progressed through an educational program to become student teachers, and eventually teachers, they needed to have the necessary skills to develop technology-rich classroom practices. When students became in-service teachers, they will facilitate the development of technology components for current curricula and train other faculty to effectively use technology as a tool.

Despite the various arguments for (Kozma, 1994; Jonassen, 1991) and against (Clark, 1994) the benefits of the use of technology in the classroom, it must be recognized that technology is now a ubiquitous part of everyday living. Pedagogy has forever been changed by technology, particular the Internet. Through the Internet, teachers are able to access subject content and educational practices to enhance learning. Intentional informational searching, project ideas and products, and many other aspects of classroom instruction are now found online. Classrooms around the country and the world are connected via the Internet and e-mail.

As educators and instructional designers expand the use of technology in classrooms, the concept of using a computer as a mindtool is being embraced. Jonassen (2000) defines mindtools as "computer-based tools and learning environments that have been adapted to function as intellectual partners with the learner to engage and facilitate critical thinking and higher order learning" (p. 9).

Based on this precept, we felt that the development of technological skills for preservice teachers was a necessary component in a methods course. We were awarded a portion of the college grant to implement technology skills with curriculum development in an existing science methods course.

Goals of the Project

Our primary goal was to introduce students to the Internet and develop skills that would benefit classroom teachers. To achieve this goal, we required students to develop an instructional unit with appropriate content for a life, earth/space, or physical science. In constructing the unit, students were required to use the Internet to search for resources, lesson ideas, and project ideas for elementary level instruction. The students spent the early part of the semester learning the interface, searching techniques, and critical evaluation of Web resources. Students engaged in discussions about the age-appropriateness of information obtained from the Web and how to use peripheral devices, such as a scanner, digital camera, and VCR, to enhance the Internet experience.

The objectives of the course were to enhance students' understanding of technology, curriculum design, and instructional practices. To enhance critical Web skills, students attended workshops on web page information evaluation, which was previously developed by the college's library services. Also, students were expected to understand the components of Web

browsing that enables them to disseminate information and store it. One effective means of storing web sites for future use is bookmarking.

The course was structured with a combination of lectures, demonstrations, hands-on and cooperative group activities. The instructional designer facilitated the technology component of the course to introduce or expand students' knowledge of the Internet and computers. From the education professor, students received information about learning theories, curriculum design, and science process skills. Combining the information from both components of the course, students created an instructional unit through and with technology features. The final product was presented in a role-play situation for an age-specific classroom.

Several classes were structured around the concepts of 'surfing' the Web and how to use the interface available. Students were given contextual hands-on exercises to complete with the Internet in the computer lab. We addressed the issue of browsing the Web in elementary schools. To keep elementary students from surfing into improper 'waters,' we explained the use of bookmarking capability to organize sites for class topics. We also explained security programs, such as Net Nanny, to limit unsupervised searching.

For the curriculum development and instructional practices, the guidelines of the National Research Council (1998) for science education and a discovery approach to science by Abruscato (1996) were combined in the elementary methods course. Students learned of and from standards as they engaged in course readings, lectures, demonstrations, hands-on and cooperative group activities. Science content, process skills, and instructional techniques were explained and demonstrated to students.

Using the Internet

At the beginning of the course, we surveyed the students' level of Internet competence. Next, we paired students for instruction so that at least one student had a moderate knowledge of the Internet. Then, the technical instructor provided hands-on Internet instruction.

When students first entered the Web, they were overwhelmed thousands of online teaching aids accessible through the Internet. Several sites have been developed for educators to share information and experiences online. Examples of these sites are: Teacher's Net at http://www.teachers.net/, Sites for Teachers at http://www.sitesforteachers.com/ and Lessonplanz at http://lessonplanz.com/. Students found that many of the sites included live chat rooms, lesson plans, e-mail contacts, project examples and more. For students to access the sites for classroom activities, as well as for personal development, they needed to understand how each component worked. They needed to know how the information from the components could be incorporated into instruction to meet lesson objectives and district curriculum standards.

Abundance does not always bring wealth, so one of our key objectives in the course was to have students become critical evaluators of sites. Critical evaluation involves three components: evaluating, analyzing, and connecting. According to Jonassen (2000), "critical thinking involves the dynamic reorganization of knowledge in meaningful and usable ways" (p. 27). When students were developing lessons, they needed to determine if the information found did indeed fit their purpose. When analyzing, students needed to organize the information into categories that had meaning for the task and realize how the sections combined to achieve their goal. By providing students with contextual problems and requiring instructional units, we facilitated their critical thinking skills and demonstrated classroom activities to develop technology skills.

Constructing Instructional Units

As the Internet training was occurring with the technical instructor, the education professor was providing students with knowledge about designing an elementary science unit. Over the course of the semester, students learned to write objectives for the units and lessons, gather resources for the unit's content, develop lesson plans using a variety of instructional methods, incorporate technology, and evaluate learning. In cooperative groups, students were expected to develop a science unit with two weeks of lesson plans. A resource list of print and nonprint materials was required for the unit.

Students were guided through regular instructional techniques and methods for assimilating technology. For example, students searched the web and reviewed sites to determine the scope of the material and grade level appropriateness of content. Students engaged in demonstration lessons that involved interaction with a website or computer program and were encouraged to incorporate the practices into their unit's lesson plans. Also available to students was the resource, Teaching with the Internet: Lessons from the Classroom by Leu & Leu (1997), for Internet and subject specific ideas.

At the end of the semester, students presented their instructional unit to the class. After basic components of the unit were shared, students presented one lesson that incorporated technology with content or technology as a part of a science activity. During the lesson, the class role-played the age level for which the lesson was designed. Students received peer and instructor feedback about the lesson and its appropriateness for the grade, content, instructional methods, and technology use.

Expanding the Project

After the initial semester, the education professor became more proficient in using technology through regular use and by attending the *Beyond the Millennium: Teaching with Technology Program* sponsored by the Astronauts Memorial Foundation and NASA. She became more comfortable with an expanded definition of technology and means of using technology in the classroom in a broader sense. To facilitate more involvement and concentrate instruction, students first developed a space exploration unit with the professor in which the combination of science content, instructional methods, and technology was modeled.

During the preparation of the space unit, students were expected to become familiar and moderately proficient in the areas of technology for using: multimedia encyclopedias; a variety of nonprint media resources for directed and independent learning activities; video and computer programs; evaluating the accuracy, relevance, appropriateness, and bias of a variety of nonprint resources; appropriate technology tools to complete a variety of tasks; computer-based drawing tools; and technology resources for problem solving. Since these competencies are expected of elementary students according to Withers (1999), it is important that their teachers have, at least, equal ability.

An example of college students' involvement with integrated technology was the data finding activity for the space exploration unit. After choosing a planet to explore, students had to find three resources and four items of information about the planet from each resource. Only one resource could be print material while the other sources could be a video or computer program on the solar system, or an Internet site. From the data, students summarized information and produced, through various media, a short report about the planet.

After students were familiar with the procedures and techniques from an educational and technological standpoint, they used the knowledge to create another unit for a physical science topic. The technical instructor and education professors were available to assist and support the students through the process.

Teacher Preparation for the Information Age

In the course, preservice teachers were first instructed in technology use, next guided through the use technology to develop classroom instruction, and then, required to create curriculum units with technology. Besides the science units designed in the course, students have the knowledge and ability to design interdisciplinary units in a similar manner. The final phase of the process is when preservice teachers are able to implement the science units during their student teaching and, subsequently, when they begin their teaching careers.

Each year that the program has been used, the quantity and quality of students' technology ability has increased and the extent that technology has been incorporated into the science units. Students reported that they used the units while student teaching and when they became inservice teachers. As with many educational goals, the results are far-reaching and fulfillment takes time. We are fortunate that our purpose of having technology as an integral part of instruction is being implemented into classrooms, and modeled by preservice teachers to inservice teachers. The opportunity of impacting instruction in the future is exponential.

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